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Determining the impact of a bowel management protocol on patients and clinicians' compliance in cardiac intensive care: a mixed-methods approach.

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Conflicts of Interest

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- 4

Determining the impact of a bowel management protocol on patients and clinicians' compliance in cardiac intensive care: a mixed-methods approach.

ABSTRACT

Background: Bowel management protocols standardise care and, potentially, improve the incidence of diarrhoea and constipation in intensive care. However, little research exists reporting compliance to such protocols in intensive care throughout patients' stay. Furthermore, there is limited exploration of the barriers and enablers to bowel management protocols following their implementation, an important aspect of improving compliance.

Aim: To investigate the impact of a bowel management protocol on the incidence of constipation and diarrhoea, levels of compliance, and to explore the enablers and barriers associated with its use in intensive care.

Methods: A mixed-methods study was conducted in cardiac intensive care using two phases: 1) a retrospective case review of patients' hospital notes, before and after the protocol implementation, establishing the levels of diarrhoea and constipation and levels of compliance; 2) focus groups involving users of the protocol, six months following its implementation, exploring the barriers and enablers in practice.

Results and Findings: 51 patients' notes were reviewed during phase one: 30 pre-implementation and 21 post-implementation. Following the protocol implementation, there was a tendency for a higher incidence of constipation and less severe cases of diarrhoea. Overall compliance to the protocol was low (2.3%). However, there was evidence of behavioural change following protocol implementation, including less variation in aperients given and a shorter, less varied time period between starting enteral feed and administering aperients. Several themes emerged from the focus groups: barriers and enablers to the protocol characteristics and dissemination; barriers to bowel assessment; nurse as a barrier; medical involvement and protocol outcomes.

Conclusions: The bowel management protocol implementation generated some positive outcomes to bowel care practices. However, compliance was low and until

1 there is improvement, through overcoming the barriers identified, the impact of such
2 protocols in practice will remain largely unknown.

3 **Key words:** Bowel management, protocol, constipation, diarrhoea, compliance,
4 practice changes, intensive care, mixed-methods

5 **IMPACT STATEMENT**

What does this paper contribute to the wider global clinical community?

- This is the first mixed-methods study to include a measure of compliance to a bowel management protocol throughout the patients' ICU stay.
- The results show that compliance to a bowel management protocol is low.
- Until compliance can be improved, the efficacy of a bowel management protocol in practice is unknown.

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1 INTRODUCTION

2 The incidence of constipation and diarrhoea can be high in intensive care (Jack,
3 Coyer, Courtney, & Venkatesh, 2010; Mostafa, Bhandari, Ritchie, Gratton, &
4 Westone, 2003). This consequently impacts on patients' recovery, with prolonged
5 time on mechanical ventilation (Mostafa et al., 2003) and impaired skin integrity
6 (Pittman, Beeson, Terry, Kessler, & Kirk, 2012). Bowel management protocols
7 (BMP) have the potential to standardise bowel care and improve the incidence of
8 constipation and diarrhoea (Dorman et al., 2004; Ferrie & East, 2007; McPeake,
9 Gilmour, & MacIntosh, 2011). However, compliance to such protocols has been
10 rarely reported, leading to uncertainty regarding the efficacy of a BMP in ICU.

11 BACKGROUND

13 Critically ill patients have complex needs that often require multiple organ support.
14 Consequently, bowel management for patients admitted to the intensive care unit
15 (ICU) can, inadvertently, be overlooked. Bowel dysfunction is a common occurrence
16 in intensive care, with the reported incidence of constipation and diarrhoea being as
17 high as 83% and 78% respectively (Jack et al., 2010; Mostafa et al., 2003). ICU
18 patients' are exposed to risk factors associated with constipation in intensive care,
19 such as, opioid use, immobility, and critical illness (Gacouin et al., 2010; van der
20 Spoel et al., 2007; van der Spoel, Schultz, van der Voort, & de Jonge, 2006).
21 Furthermore, it is common for these patients to have difficulties weaning from
22 mechanical ventilation, thus prolonging their stay on the ICU (Mostafa et al., 2003).
23 Enteral feeding and antibiotic therapy are common interventions for patients in
24 intensive care, and these have been strongly associated with diarrhoea (Jack et al.,
25 2010; Thibault et al., 2013). Prolonged episodes of diarrhoea can compromise skin
26 integrity, increase the risk of cross contamination of infection to other wound sites,
27 and lead to an increased burden on nurse time (Bayón García et al., 2012; Binks et
28 al., 2013; Pittman et al., 2012).

30 Research has suggested that a BMP would be beneficial to ICU patients as they
31 guide clinicians' management of bowel care and subsequently improve the incidence
32 of constipation and diarrhoea for these patients (Dorman et al., 2004; Ferrie & East,

2007; McPeake et al., 2011; Ring, 2011). However, earlier studies tended to be single-centred quasi-experimental designs, contaminated with various confounding variables, demonstrating little cause and effect and a lack of power due to small sample size. A more recent study also investigating the impact of a BMP in the ICU, adopted a multiple centre quasi-experimental approach using three ICUs in Australia, thus providing more power and robust evidence (Knowles, McInnes, Elliott, Hardy, & Middleton, 2014). Interestingly, no significant differences were found in the incidence of constipation and diarrhoea following its implementation. These mixed results do raise further questions regarding the efficacy of a BMP in practice.

It is likely that the impact of a BMP may be influenced by clinicians' resistance to change. Knowles et al (2014) conclude that a lack of compliance to their BMP was the likely explanation for their results. The evidence seems to support this notion. In comparison to the study by Knowles et al (2014), previous research has demonstrated improved nurse documentation and assessment following the implementation of a BMP (Dorman et al., 2004; McPeake et al., 2011), which also supported the findings by McKenna, Wallis, Brannelly, & Cawood (2001). Therefore, at the very least, the implementation of a BMP increased awareness of the issues associated with bowel care which promoted thorough assessments and documentation, providing evidence of a change in behaviour among clinicians. As recent studies have failed to support these findings (Knowles et al., 2015, 2014), a lack of compliance to a BMP does explain why the intervention by Knowles et al (2014) failed to change the behaviour of clinicians.

Knowles et al (2014) utilised a measure of compliance and found that 34% of clinicians adhered to the protocol. This figure was based on a prescription on aperients on day one of patients' admission. Unfortunately, previous BMP studies have not attempted to measure compliance to the protocol, therefore, comparisons cannot be made (Dorman et al., 2004; Ferrie & East, 2007; McPeake et al., 2011; Ring, 2011). In contrast, studies investigating the implementation of other protocol-based interventions in intensive care, e.g. central venous lines, sepsis and ventilator care bundles, have frequently measured compliance (Borgert, Goossens, &

1 Dongelmans, 2015). Due to the different methodologies adopted, it is difficult to
2 compare the BMP compliance figure with other studies. However, the apparent slow
3 progress in behaviour change related to bowel management implementation, in
4 comparison to other types of protocol-based implementation, warranted further
5 attention. Furthermore, the measure of compliance utilised by Knowles et al (2014)
6 was merely a snap-shot figure, which may not represent the overall level of
7 compliance throughout the patient's entire stay in the ICU. A 'composite' measure
8 can be used, by which a fraction of the care actually given is calculated against the
9 care that could have been given, i.e. length of stay in ICU (Benneyan, 2009).

11 Implementation research has highlighted the importance of an iterative process of
12 knowledge to action (Graham et al., 2006). Specifically, further assessments of the
13 barriers to change, after piloting the BMP should be adopted to identify additional
14 enablers and barriers once clinicians have had the time to familiarise themselves
15 with the BMP. For example, it is likely that barriers identified from the introduction of
16 the BMP in Knowles et al (2014) were different to the ongoing barriers. Using this
17 iterative process can facilitate future refinements to a BMP and implementation
18 strategies to overcome the barriers to change. Knowles et al (2014) suggested using
19 Cahill's model to support the exploration of barriers and enablers to the
20 implementation of a BMP in intensive care (Cahill, Suurdt, Ouellette-Kuntz, &
21 Heyland, 2010).

23 A BMP was introduced in a Southwest Cardiac Intensive Care unit to reduce
24 variation in practice and reduce patient discomfort (see Figure 1). This paper reports
25 on the findings of this evaluation.

26 *Figure 1 here

METHODS

Aims and Objectives

This overall aim of this study was to evaluate the implementation of a BMP in a cardiac intensive care unit using the following objectives:

1. Ascertain the impact that the implementation of a BMP had on the incidence of constipation and diarrhoea.
2. Identify the level of clinician compliance to the BMP.
3. Explore the barriers and enablers of a BMP after its implementation to help future refinements of BMP implementation.

Study Design

This study adopted a mixed-methods approach to evaluate bowel management implementation in cardiac ICU which was considered appropriate in terms of alignment with the aims of the study. As such, the study was conducted in two phases. Phase one involved an uncontrolled pretest-posttest retrospective case review to evaluate the impact the BMP had on the incidence of constipation and diarrhoea, and to identify a level of compliance to the BMP using a “composite” measure (Benneyan 2009). The second phase involved an exploration of the barriers and enablers following the implementation of a BMP to overcome the difficulties of transferring knowledge into practice (Graham et al., 2006).

Phase One: Case Review

Sample

Using a convenience approach to sampling, patients from a single-centre 18 bedded cardiac intensive care unit (CICU) in a large NHS Trust were included in this study, in line with the criteria stated in Table 1. These were informed by criteria utilised in previous research (McPeake et al., 2011; Ring, 2011; Knowles et al., 2014), as well as excluding patients with conditions or clinical manifestations considered to be contraindicating to initiating the BMP. The sample size of this study was governed by the number of eligible patients obtained within the time constraints of the project, thus no power calculation was performed.

*Table 1 here

1 Patients were identified via a search of the electronic documentation system in use
2 in the CICU, conducted by an independent cardiothoracic data manager. Medical
3 and nursing notes for the retrieved patients were then examined, and included or
4 excluded based on the criteria outlined in Table 1. Patients who developed an upper
5 gastro-intestinal bleed were included up until the day this had clinically manifested,
6 e.g. melena, or once the source of the upper gastro-intestinal bleed was corrected
7 and all clinical manifestations had subsided.

8 *Data Collection*

9 The implementation of the BMP took place during July to October 2015. Data were
10 collected retrospectively to capture the pre-implementation phase from 28th February
11 to 30th June 2015 and the post-implementation phase from 20th October 2015 – 15th
12 April 2016. All data collected were standardised using a data collection tool. As no
13 previous audit tool, specific to the data related to the BMP and bowel management,
14 was available, a new audit tool was designed to collect data on all the outcome
15 measures outlined below.

17 *Outcome Measures*

18 Outcome measures included demographic and clinical characteristics, as well as the
19 incidence of constipation and diarrhoea. A measure of compliance for each patient
20 included in the study was also incorporated using a composite measure. All outcome
21 measures are outlined in Table 2.

22 *Table 2 here

24 *Data Analysis*

25 Data were analysed utilising IBM SPSS 22 for Windows, with statistician support.
26 “Time to first bowel movement” was the primary outcome variable for the study, as
27 well as the main continuous variable, and consequently normality tests were
28 performed on this variable, e.g. Kolmogorov-Smirnov tests and histogram plots.

30 Following data checking and cleansing, missing data for one patient was noted,
31 arising from the inability to locate this patient’s drug chart. Therefore, it was not

possible to measure the variables regarding aperiient administration and compliance. Descriptive statistics for continuous variables were performed and frequencies were used to explore categorical variables. Inferential analyses were performed using a significance level of $p < 0.05$ (2-tailed). Given the independent samples between the pre-test and post-test, Mann-Whitney U and Chi-square tests were performed to identify differences between variables in the pre-implementation phase and the post-implementation phase.

Phase Two: Focus Groups

The qualitative phase of the study involved conducting focus group interviews with clinicians to explore real life barriers and enablers of the BMP in practice.

Sampling and Setting

Purposive sampling was used to invite clinicians currently employed by the cardiac intensive care at the research site. Only healthcare staff who were users of the BMP were eligible to partake in the two focus groups and these were recruited via poster advertisement displayed in the staff room, invitations sent via social media (a private Facebook group) and via NHS email (addresses obtained via NHS mail). Those who expressed interest in the focus group were given information sheets and consent forms prior to the allotted focus group, either attached as an email or given as a hard copy. Each focus group was conducted in a private room within the CICU in April 2016.

Data Collection

The focus group was facilitated using an interview guide informed by Creswell (2009) and The Framework for Adherence to Nutritional Clinical Practice Guidelines in ICU, by Cahill et al (2010), as suggested by Knowles et al (2014), to support the exploration of barriers and enablers to the implementation of a BMP in intensive care. Questions asked during the focus groups adopted a semi-structured approach (See Table 3). An observer took field notes for cross referencing during data analysis. Audio-recording devices were utilised and recordings of dialogues were

transcribed, verbatim. Transcripts were sent to four members of the focus groups who had volunteered to member check.

*Table 3 here

Data Analysis

The data underwent thematic analysis, guided by Braun and Clarke (2006). An inductive approach to thematic analysis was initially used to extract codes and themes, and these were then cross-referenced to The ICU Framework for Adherence, by Cahill et al (2010), which either supported or challenged the codes and themes. The themes were identified by the main author, and a sample of these were then checked by the co-author. No conflict of ideas between researchers arose.

Ethical Issues

Ethical approval was obtained by the University of Plymouth and the project was also registered as a service improvement study with the audit team at the study site.

RESULTS

Phase One: Case Review

Figure 2 depicts the flow of patients, whose documents were included within this case review. A total of 70 patients' notes were retrieved and audited; 37 pre-implementation and 33 post-implementation. Following review of the notes against the inclusion criteria, a total of 19 were excluded: 7 pre-implementation and 12 post-implementation. Thus, the analysis was undertaken on the 52 remaining case notes; 30 pre-implementation and 21 post-implementation.

*Figure 2 here

Patients' demographic and clinical characteristics are summarised in Table 4. There were no significant differences found in these characteristics between patients in the pre-implementation and the post-implementation phase.

*Table 4 here

Incidence of Constipation

Incidence of constipation was explored and the results summarised in Table 5. There was a significantly greater proportion of patients who were constipated within 96 hours from admission in the post-implementation phase compared to the pre-implementation phase. However, no significant differences were found between the two groups when the variables hours until first bowel movement, episodes of constipation during ICU admission (BNO > 72 hours), and the number of patients who were constipated within the first 72 hours.

*Table 5 here

Incidence of Diarrhoea

Results of the statistical analyses exploring the incidence of diarrhoea are also presented in Table 5. There were no significant differences found between the two groups for the number of patients who developed diarrhoea, and the number of days that patients had diarrhoea. However, scrutiny of the data revealed that use of flexi-seals had significantly reduced post-implementation of the BMP.

Compliance

Composite Compliance

The median overall compliance was 2.38% (*IQR* = 0-39%, *n* = 12). These results reflect the level to which clinicians completed or responded to all aspects of the BMP. Clinicians adhered well to initially starting Senna and Lactulose, and omitting aperients when diarrhoea presented. Clinicians did not adhere so well to performing a rectal (PR) investigation, and increasing the dose of aperients when patients had no bowel movement. The median nurse documented compliance was 85.97% (*IQR* = 44.38 – 98.91, *n* = 12). This reflects the number of nurses documenting on the daily care plan that they had complied with the BMP during their shift.

Behaviour change

There was a small increase in the number of times a PR examination was performed ($n = 6$ (28.6%) in the post-implementation phase compared to the pre-implementation phase ($n = 4$, 13.3%) but this difference was not significant.

Other changes in behaviour were noted (see Figure 3 and 4). The time period from starting enteral feed to commencing aperients was less varied in the post-implementation phase, with the majority starting aperients day two (61.5%, $n = 8$), compared to day three (32%, $n = 8$) in the pre-implementation phase. Furthermore, a greater portion of patients received Senna and Lactulose, with less variability in aperient administration in the post-implementation phase compared to the pre-implementation phase. Inferential testing was not performed on the above variables due to the violation of assumptions.

*Figure 3 here

*Figure 4 here

Documented Days of Bowel Assessment

The days of bowel assessment documented on the fluid chart increased in the post-implementation phase ($Md = 60$, $IQR = 22.50 - 85.71$, $n = 30$) compared to the pre-implementation phase ($Md = 50$, $IQR = 24.91 - 61.28$, $n = 21$). However, this figure was not statistically significant ($U = 244.000$, $z = -1.360$, $p = .17$).

Phase Two: Focus Groups

Two focus groups were conducted, of approximately 20 to 30 minutes duration. Each focus group contained five participants, who were all female nurses; no male nurses volunteered to take part. Participants had a variety of critical care experience from preceptor to management posts. Codes and themes were extracted and cross references made to Cahill et al (2010) (see Table 6).

*Table 6 here

1 *Barrier and Enablers to BMP characteristics*

2 Participants across both focus groups found the format of the BMP to be user-
3 friendly:

4 'It's straight forward, you can just go right, what are we on, where are we
5 looking at, and kinda follow the steps. There's no sort of, oh is it this? Is it that?
6 It's quite simple.' [FG1, F1]

7 'You've always got something to follow if that makes sense, it's very structured.
8 It's easy to follow.' [FG2, F5]

9

10 Participants also commented on the appearance of the BMP. At first, they found the
11 BMP to be overwhelming due to the number of boxes used in the algorithm, and
12 because of this, one-to-one support was important to overcome this barrier.

13 'I think when you look at it, it can feel a bit overwhelming. I remember the first
14 time I saw I was like 'oooh.' [FG1, F1]

15 'Yeah it's all those boxes' [FG1, F5]

16 'But you cannot be like that, there's no way around that really, so I think that's
17 probably why it is helpful that someone talks it through.' [FG1, F1]

18

19 There was also a comment made regarding the ambiguity of the statements on the
20 BMP. More specifically, it was suggested that the "absorbing" statement was unclear
21 regarding its clinical application.

22 'You know when it says commence enteral feed, absorbing, is that they have to
23 absorb for 24 hours, because that doesn't say, it just says absorbing.' [FG1,
24 F3].

25

26 There also appeared to be some confusion regarding the patient groups who could
27 be commenced on the BMP. References were made towards patients with reduced
28 gut motility and questioning the applicability of BMP to such patients. Furthermore,
29 the bowel management needs of the vascular patients were also raised, questioning
30 whether this patient group should also be commenced on the BMP.

31 'We don't really get vascular that stay that long but should they be included in
32 this?' [FG1, F5]

33 'Umm at the moment, we've got a patient who is being TPN, not absorbing, so
34 how would you go about bowel?' [FG1, F3]

Barriers and Enablers of Dissemination

Participants in both focus groups recalled the following methods of dissemination: email, clinical educator and the researcher providing one-to-one detailing of the BMP contents. Other nurses were informed of the BMP by word of mouth. Some members of the focus groups appeared uncertain with how the information was disseminated to them. Participants considered the reminder located on the electronic information system as an effective prompt for all nursing staff. Recommendations for further dissemination methods were: safety briefs, team and ward meetings.

'I think, I remember at the time it was quite thorough wasn't it. It was people being taken....taken away and individuals or twos and had it talked through with them.' [FG1, F1]

'And now it's on Innovian, it's even more sort of likely to remind you even more now' [FG2, F1]

The nurses also talked about the lack of availability of the BMP at times and requesting additional fixed copies.

'We need more, cos I can never find a flow sheet' [FG2, F1]

'If we could just get a big one for the wall or something just so it's there, and it stays there' [FG2, F5]

A couple of nurses made references to the issues with stock, including suppositories, which meant they skipped a step on the BMP, hindering the implementation process to patients.

'We did have issues getting hold of them, I think one shift I was on, so I think we sort of jumped that one and went to that one (pointing to the next stage in the BMP) because we couldn't get hold of any, so you know, that was a stock issue rather than anything else.' [FG1, F3].

Medical Involvement

In both focus groups, there were opposing views regarding the support from the medical team. Some participants suggested that the BMP dissemination process to the medical team was insufficient, that there was a resistance to prescribe aperients and that the BMP was not always followed on the ward round.

'We have some junior doctors that are ummm questioning it, refusing to prescribe things.' [FG1, F5]

1 'I've had it before where a consultant didn't think that the, when it could have
2 got to day 5 or something like that, and X-ray part wasn't necessary. I think that
3 person ended up with a GI bleed actually.' [FG1, F4]

4
5 Others found the medical staff to be supportive of the BMP, especially related to
6 prescribing of medication, but resistance had been encountered when a patient
7 required a PR examination.

8 'The doctors aren't very forthcoming with doing it.' [FG2, F5]

9 'To try and get the doctor to do them isn't easy.' [FG2, F1]

10
11 When discussing the benefits of the BMP, one participant commented:

12 'It's much quicker as well than having to go to the doctor or go somewhere else.
13 It's like you follow that and then you just go to the doctor and you say "following
14 the bowel protocol, my patient needs to start aperients" and then they prescribe
15 it.' [FG2, F5]

16 17 *Barriers to Bowel Assessment*

18 The nurses discussed the difficulties encountered when it came to making
19 assessments of the bowel and nutritional intake. Assessment of sufficient dietary
20 intake was identified as an area needing greater clarification, and that nurses felt
21 they had to make a judgement call regarding this. The lack of documentation
22 regarding dietary intake was also highlighted.

23
24 'It's difficult sometimes to work out whether they've had 48 hours of food,
25 because if they haven't had a food chart, and they haven't documented that
26 they have had diet on Innovian, its difficult when to start it.' [FG1, F5]

27 'It's a little bit down to interpretation. I know there is something on the board
28 isn't there about what is sufficient dietary intake, or something, but ummm.....I
29 think it's probably a little bit subjective in practice.' [FG1, F4]

30
31 Difficulties in establishing a patient's last bowel movement and dealing with this
32 uncertainty also arose; partly due to a lack of documentation. As a result, nurses
33 were having to assume that the patient's last bowel movement was on the day of

1 surgery. This was especially relevant for patients who had been admitted from
2 another part of the hospital, or another hospital.

3 'We don't always know when necessarily when they last had their bowels open
4 as well.' [FG1, F4]

5 'Cos I always kind of go on the day they've gone to theatre. I never know if
6 they've opened them.' [FG1, F1]

7
8 Lack of confidence with performing PR examinations also emerged from participants.
9 They expressed their concerns regarding whether nurses were permitted to perform
10 a PR examination, and a lack of competencies around this skill. The need for
11 additional training arose.

12 'Yeah I'd say there is a confidence issue amongst staff whether or not to do it,
13 they might cause some damage by them doing it.' [FG2, F3]

14 'Cos we're not really, I've never done a competency in it, other than putting in a
15 flexi-seal, but that's a bit different.....there's never been a competency in it.'
16 [FG2, F1]

17 18 *Nurse as a Barrier*

19 This theme emerged several times manifesting in different conversations. Firstly,
20 there were references made to the variation in care after the implementation of the
21 BMP. In particular, it was highlighted that there were some nurses who did not
22 always follow the BMP, or failed to escalate the care as per BMP recommendation.

23 'I was looking after a patient who was day seven and hadn't had her bowels
24 opened, hadn't had a PR, so I gave her a PR and suppositories that morning
25 and I think after the second lot of suppositories she went, but it was that she got
26 to day seven without ummmm, was having Senna and Lactulose, but that
27 wasn't doing the job, they just kinda kept going on.' [FG1, F4]

28
29 It was also highlighted that some nurses were less compliant with following the
30 'diarrhoea' aspect of the algorithm, including a reluctance to send stool specimens to
31 microbiology. This appeared to arise from wanting to avoid barrier nursing the patient
32 after sending a stool specimen because of the additional work and delays in
33 discharging the patient to the ward.

1 'Four or five days they've had loose stools, and no one's sent a specimen.....'
2 [FG1, F3]

3 'And also, its then an issue for us transferring to the ward, which it shouldn't be
4 because they are now barriered, so we, if they're not c-diff, it's not such a
5 problem, and you've got the result like we're supposed to, its fine cos they'll
6 barrier them in the bay.' [FG1, F5]

7 'I think we're very good at using it to start aperients, but when it comes to
8 having bowels open and.....and its diarrhoea and then, where actually you
9 can come back and still refer to this, whereas we're not so good at coming back
10 to it and carrying on when they've actually had their bowels open if that makes
11 sense.' [FG2, F5]

12
13 Nurses' previous experiences and practices appeared to interfere with the
14 implementation of the BMP in practice.

15 'If anyone's got any presumed practices from before, that they're just stuck, this
16 always use to work.' [FG2, F3]

18 *BMP Outcomes*

19 Nurses highlighted several outcomes from the implementation of the BMP, captured
20 under three subthemes: improved patient care; increased awareness, and increased
21 work load.

22 *Improved Patient Care*

23 Positive changes in practice were noted following the implementation of the BMP,
24 including a reduction in incidence of constipation and that patients were opening
25 their bowels more frequently. Furthermore, bowel care appeared more standardised
26 in comparison to previous practice.

27 'I think their bowels are opened a lot more regularly, especially in HDU.' [FG1,
28 F5]

29 'It seems to be that not so many people are in trouble you know, whereas
30 before it would be quite common that you've had a person days and days
31 nothing's happened and it's like turning into a major event like child birth...'
32 [FG2, F3]

33 'Everyone gets the same management...because before, it could be very
34 random...it would be, you know, who was on, what their opinions are, what the
35 doctor's opinions are, should we intervene, shouldn't we. Whereas now it's
36 concrete, it's black and white.....' [FG2, F3]

1 The BMP appeared also to have impacted positively on the patient's psychological
2 well-being:

3 'I think the patients are quite happy with it because I think they start to worry as
4 well if they haven't had their bowels open.' [FG2, F5]

5 'It's a reassurance tool as well for them you can, particularly in HDU, where
6 people are speaking more as I've discovered over the last few weeks (laughing)
7 ummm they are worried about their bowels, but once you say, you know, you're
8 on a certain programme, it's very common to have problems, there's this
9 specifically designed programme, you're on it and we're managing it, patients
10 seem to go 'alright then', and feel better.' [FG2, F3]

11 *Increased Awareness*

12 Participants also noted increased awareness of bowel management and nutrition,
13 which had improved their assessments of patients.

14 'I found that it's in my mind a lot more since, since you've, we've had it sort of
15 disseminated. I think it's more at the forefront of my mind, as part of what, how
16 I'm assessing my patient all the time. And it's also, I'm not thinking about it
17 further down the line like I used to. It's sort of in my head straight away, post-
18 op.' [FG1, F2]

19 'It's good because it makes you think about nutrition as well, are they actually
20 eating enough to have their, you know, for things to be moving....kinda makes
21 you think a bit more into it....i think.' [FG2, F5]

22 *Increased Workload for Nurses*

23 A negative outcome of the BMP was that workload was perceived to have increased;
24 patients were requiring the commode more frequently, particularly in HDU, leading to
25 additional nurse responsibilities.

26 'I do feel the commode is used a lot more in HDU. It's a good thing, but yeah
27 it's probably...(sigh) we sit them on because they've got a bit of wind, and then,
28 they probably use it about four times a day.' [FG1, F5]

29

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DISCUSSION

The aim of the BMP was to reduce the variation in care and to prevent constipation and diarrhoea through a proactive approach. This project focused on evaluating its implementation particularly to three key areas of clinical practice in the ICU; compliance, reducing constipation and reducing diarrhoea.

Measuring compliance in the current study was performed to evaluate the implementation process, level of compliance and to assess the potential impact that compliance to the BMP had in practice. This study found that compliance to the BMP was low at 2.38%. As this was the first study to incorporate a measure of clinicians' compliance to the BMP throughout the patient's ICU stay, reliable comparisons cannot be made to previous studies. However, other protocol based care in ICU, e.g. VAP care bundles, have reported higher composite compliance levels, between 70-84% (Crunden, Boyce, Woodman, & Bray, 2005). The BMP is a more complex protocol in comparison to the check-list nature of the VAP care bundle which explains this large discrepancy and the need for a mixed-methods approach to explore the questions raised over the barriers to implementation to a BMP.

There were several enablers identified in the focus groups which included the user-friendly characteristics of the BMP and the reminder on the daily care plan which align with those suggested by Cahill et al (2010). However, the barriers identified from the focus groups help to explain the results further. Full compliance to the BMP involved a daily assessment and escalation of bowel care. This figure (2.38%) reflects how clinicians complied with some elements of the BMP, e.g. administering laxatives when patients were having no bowel movements but were less compliant with other aspects, which included escalating care and treatment, e.g. administering suppositories. The identification of the need for suppositories required a PR assessment. This study identified that very few PR assessments were performed, before and after the BMP implementation. A nurse initiated PR assessment was a new practice implemented to support the BMP. Nurses could perform this assessment if they felt competent in doing so to assess the presence of stool in the rectum and identify whether treatment escalation was necessary. This was formally introduced to empower nurses and to allow autonomy when managing bowel

1 function. However, the findings identified from the focus groups, 'barriers to bowel
2 assessment' suggested that the perceived lack of nurses' confidence in performing
3 PR assessments, appeared to be a barrier to complying with this element of the
4 BMP. A lack of confidence in skills as a barrier to implementation has been
5 supported by the Theoretical Domains Framework (Cane et al., 2012) and suggests
6 that gaps in training and education are at work and need addressing to improve
7 compliance to this aspect of the BMP.

8
9 The focus groups also revealed that the medical staff were reluctant to perform a PR
10 assessment. It was implied that this impacted on the nurses' confidence, and
11 compliance to this element of the BMP. This apparent lack of medical support may
12 be due to negative associations of that activity, as jobs with negative connotations
13 associated with it are likely to act as a barrier (Michie et al 2005). Furthermore, the
14 case review revealed shortcomings in medical staff documentation of a bowel
15 assessment for patients, e.g. last bowel movement. Research has highlighted the
16 importance of a multi-disciplinary approach for an effective change in bowel
17 management practice (Poenaru et al., 1997). Thus this apparent ineffective multi-
18 disciplinary approach to bowel management in the CICU was likely to hinder the
19 implementation process and compliance to the protocol (Cane et al., 2012; Michie et
20 al., 2005).

21
22 Focus groups also highlighted a reluctance to change practice, a barrier that is likely
23 to impede the assessments of a newly implemented BMP from being carried out.
24 This barrier is well supported in the literature relating to implementation (Cane et al.,
25 2012; Grol & Wensing, 2004; Michie et al., 2005). Research has suggested that this
26 reluctance may be more frequent among older and more experienced nurses, as
27 their professional views may clash with elements of the BMP (Cahill et al., 2010;
28 Cane et al., 2012; Michie et al., 2005). As compliance to a newly implemented
29 protocol requires behavioural change, understanding and overcoming reluctance to
30 change previous practices is integral to improving compliance to the BMP.

1 Interestingly, there was a large discrepancy identified between overall compliance
2 (2.38%) and nurse documented compliance (85.97%) suggesting that there were
3 differences between their perception of complying to the BMP and actual compliance
4 to it. This highlights gaps in the nurses' understanding of the BMP. The methods
5 used to disseminate the protocol were varied, as highlighted in the focus groups,
6 which may also have impacted on the interpretation of the BMP. One-to-one in
7 service teaching sessions were considered to be useful; identified as such by Cahill
8 et al (2010). However, not all nurses were able to receive this method of
9 dissemination, with some nurses being informed via word of mouth. Thus, there may
10 have been some misinterpretation of the BMP. This highlights educational and
11 training needs into the elements and the application of the BMP.

12
13 The study by Knowles et al (2014) suggested that a lack of compliance to their BMP
14 was the likely explanation for the limited impact on the levels of constipation and
15 diarrhoea. Despite low levels of compliance established in the current study, the
16 implementation of the BMP had an impact in practice. The BMP advocated early
17 administration of aperients, in an attempt to prevent constipation from occurring, a
18 practice underpinned by research (de Azevedo, Freitas, Ferreira, Pontes de
19 Azevedo, & Machado, 2015; Masri, Abubaker, & Ahmed, 2010). However, the results
20 of the current study suggested that, following the BMP implementation, there was a
21 tendency for a higher incidence of constipation, with a significant difference noted in
22 the number of patients constipated within the first 96 hours. Further analysis
23 revealed that there was a decrease in the number of patients receiving aperients
24 during their ICU admission following the BMP implementation, a finding that explains
25 the higher incidence of constipation. Normally, aperients are administered to patients
26 with normal gut function within the first 24-48 hours of admission. However, we found
27 that there were patients who were not started on aperients within this time frame
28 following the implementation. Findings from the focus group suggested that there
29 was ambiguity arising from the statements on the BMP. More specifically, focus
30 group members suggested that the 'absorbing' statement on the BMP (see Figure 1)
31 was ambiguous and not fully understood, resulting in uncertainty with regards to the
32 timing of initiating aperients. This confusion may have delayed clinicians in
33 administering aperients, leading to increased levels of constipation. Ambiguity of

1 protocol statements and a lack of knowledge of the procedures involved were
2 identified as barriers in previous research (Cahill et al., 2010; Cane, O'Connor, &
3 Michie, 2012; Michie et al., 2005). This suggests that the contents of the protocol
4 need to be clearer, both on face value and during the dissemination process.

5
6 This confusion over the elements of the BMP can also explain the results relating to
7 levels of diarrhoea. The results demonstrated a tendency for less cases of diarrhoea
8 and a significant reduction of the number of faecal-management systems used
9 following the implementation of the BMP suggesting there were less severe cases of
10 diarrhoea. This result initially appears to be a positive outcome and previous studies
11 have also found that the implementation of a BMP helped to reduce levels of
12 diarrhoea which was attributed to the implementation of a BMP (Ferrie and East
13 2007; McPeak et al 2011). However, with the low levels of compliance to the BMP in
14 the current study, it is unlikely that the implementation of the BMP is the driving
15 factor behind these results. It is possible that the overall reduction in the number of
16 aperients administered following the implementation explains the reduction in levels
17 of diarrhoea.

18
19 Although this was the first study to measure compliance throughout patients' ICU
20 admissions, the composite measure adopted did not set out to measure a change in
21 behaviour as it did not differentiate between bowel practices before and after the
22 BMP implementation. However, there was some evidence of behaviour change.
23 Following the BMP implementation, there was an increase in nurse documented
24 days of bowel assessment on the fluid chart, which was also seen in other studies
25 (Dorman et al., 2004; McKenna et al., 2001; McPeake et al., 2011). Furthermore,
26 following the BMP implementation, there was less variation in the type of aperients
27 prescribed, as well as the time from enteral feed starting to aperients being
28 commenced, with the majority starting aperients earlier following the implementation,
29 supporting the findings by Dorman et al (2004). This suggests that, despite low
30 compliance to the BMP, the implementation promoted practice changes to bowel
31 care, and compliance with some of the elements of the BMP, thereby reducing the

variation in care. This was also mirrored in the findings from the focus groups which suggested the BMP increased awareness and improved patient care.

Bowel management in intensive care is under-researched. A recent systematic review investigating the use of bowel protocols in intensive care has highlighted the scarcity of rigorous research in this field (Oczkowski, Duan, Groen, Warren, & Cook, 2017). This study was the first of its kind to incorporate a measure of compliance throughout the patient's ICU stay. Future studies investigating compliance into BMPs should utilise the results of this study as a benchmark for comparisons of compliance levels. Furthermore, this is the first study to explore the barriers and enablers of a BMP after its implementation, which is in keeping with the KTA framework (Graham et al., 2006). As qualitative research focussed on exploring the use of BMP in intensive care is scarce, this can further contribute to understanding the psychological and social processes involved when using a BMP in practice.

The results of this study were used to improve practice locally, and the transferability of the findings are limited due to the small sample and single-centred approach taken. Consequently, caution should be taken when interpreting these results as factors other than the implementation of the BMP may account for the reduced variation and changes in bowel movements. Furthermore, as the sample size was not determined by a sample size calculation, the study was underpowered and type II error may explain the lack of overall statistical findings. In addition, data saturation in phase two of the study was not achieved due to time constraints associated with this study. The researcher was also a novice interviewer with prior working relationships with the participants of the focus groups. This may have impacted on the content of the focus group discussions and the quality of the findings.

CONCLUSION

Protocol-based care has the potential to standardise and improve the bowel management of patients in intensive care. This study demonstrated that implementing a BMP led to some improvements in the management of bowel care,

1 i.e. reduced variation. However, it demonstrated the difficulties in achieving
2 compliance to the BMP. Until higher levels of compliance can be achieved, the
3 impact of the BMP in practice will remain largely unknown. The research concerning
4 BMPs in intensive care is limited and there is much progress to be made. Working
5 with the barriers and enablers identified in this study, and using an iterative process
6 to implementation via a mixed-methods or qualitative approach, may contribute to
7 overcoming apparent resistance of using a BMP.

8 **Relevance to practice**

10 The implementation of a BMP can be a cost-effective method of reducing variation
11 and improving efficiency. The BMP requires modifications to enhance its use in
12 practice. The enablers identified can be utilised to effectively disseminate other
13 protocols in the future. However, the research highlighted barriers resulting in the
14 development of an action plan for future work (see Table 7).

15 *Table 7 here

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Bowel Management Protocol for Adults in Cardiac Intensive Care
(excludes patients with spinal cord injury and chronic liver disease)

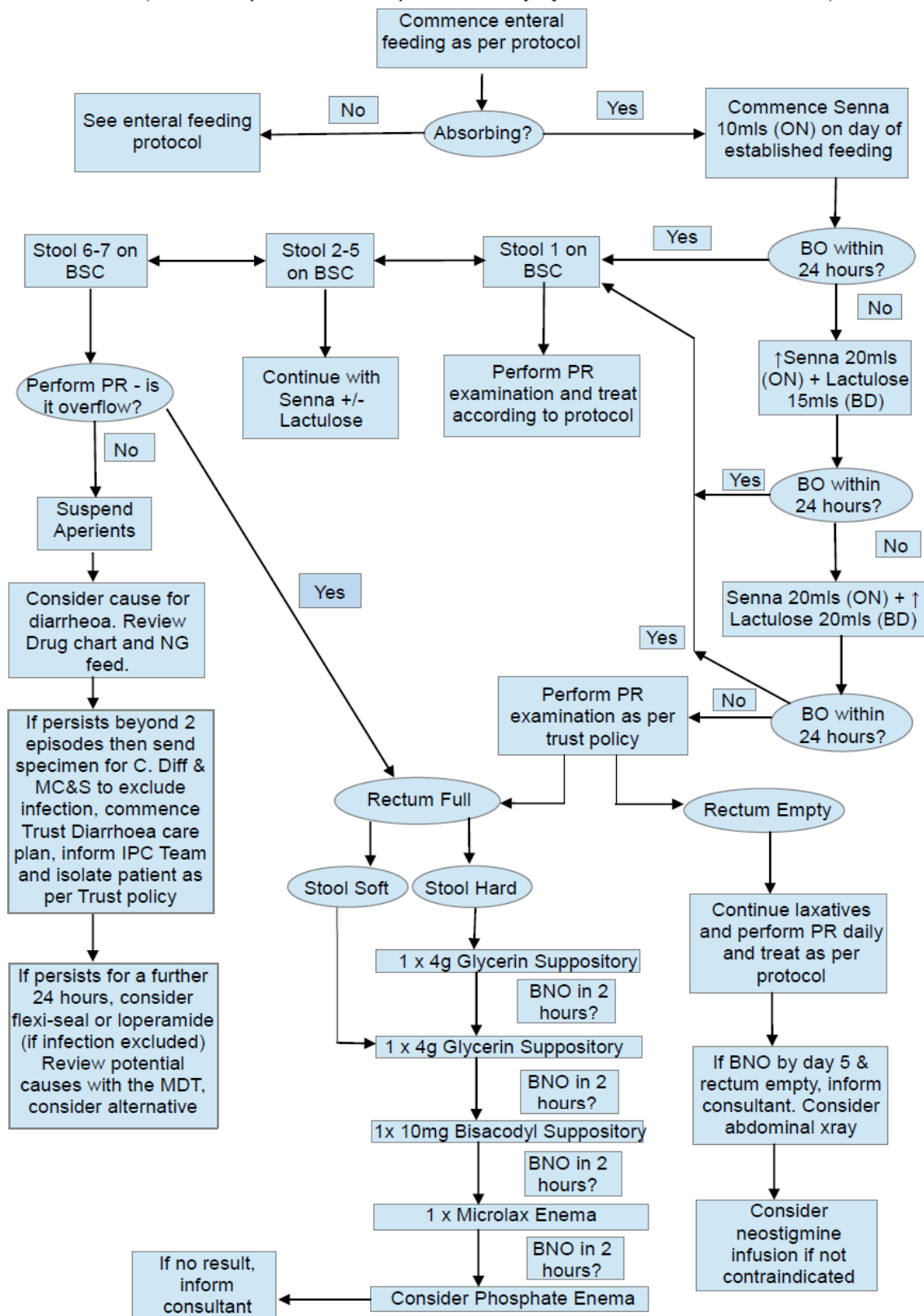


Figure 1 Cardiac ICU Bowel Management Protocol

PR Per Rectum, *BSC* Bristol Stool Chart, *BO* Bowels Open, *BNO* Bowels Not Open, *ON* once at night
BD twice daily *MDT* Multidisciplinary Team *IPC* Infection Prevention Control

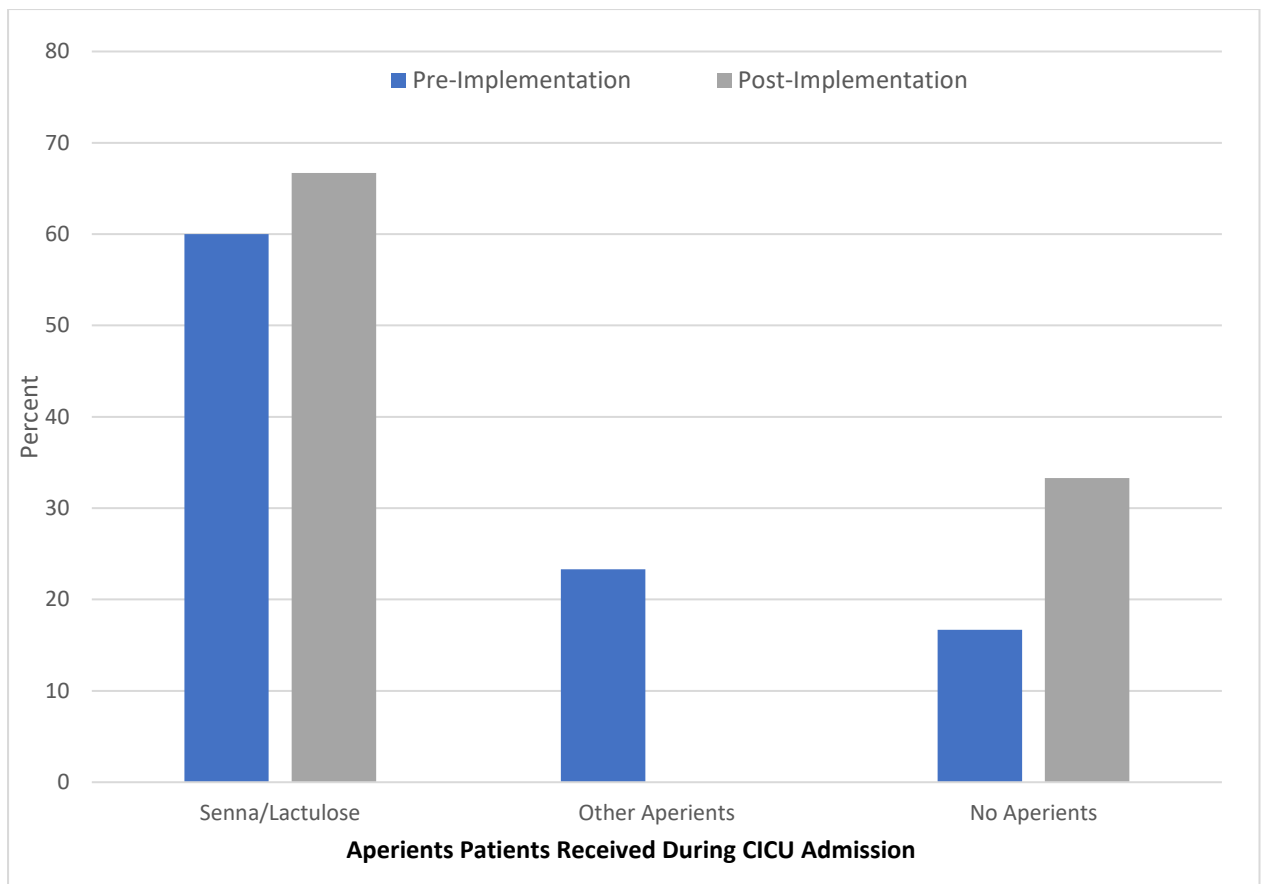


Figure 4 Aperients administered during patients' ICU stay

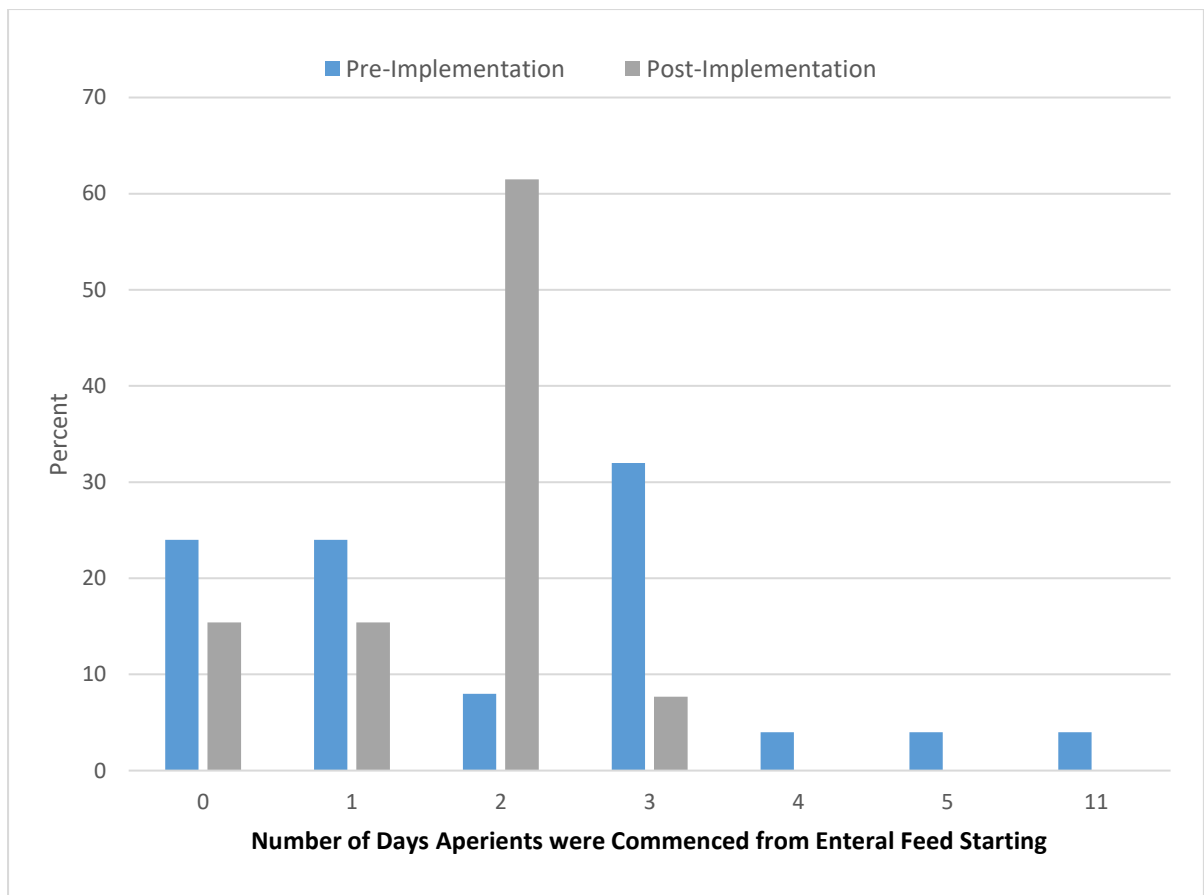


Figure 3 Number of days' aperients started from commencing enteral feed

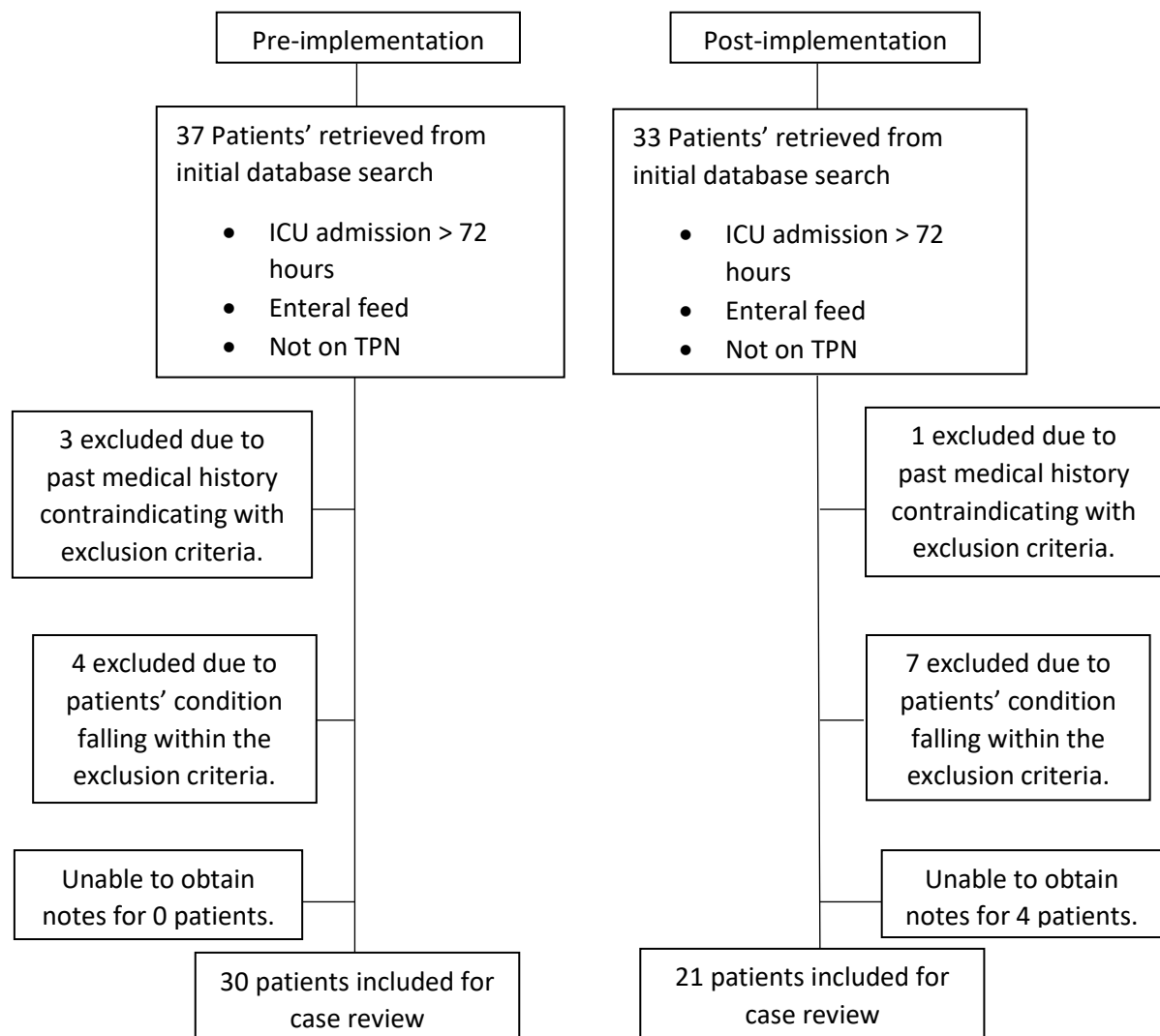


Figure 2 Flow of patients included for pre-implementation and post-implementation

1 **Table 1** Eligibility, inclusion and exclusion criteria during phase one

<u>Eligibility Criteria</u>	
<ul style="list-style-type: none"> • Length of stay > 72 hours in intensive care • Over 18 years of age 	
<u>Inclusion</u>	<u>Exclusion</u>
<ul style="list-style-type: none"> • Enteral feeding 	<ul style="list-style-type: none"> • Feeding via total parenteral nutrition • History of bowel or gastric surgery • Intestinal ileus/obstruction during stay • Ileostomy in situ • History of inflammatory bowel disease • Upper gastro-intestinal bleed • Spinal cord injury • Chronic and acute liver disease

2

3

1 **Table 2** Outcome measures during phase one

<u>Demographics/Clinical Characteristics</u>	<u>Patient Outcomes</u>	<u>Compliance</u>
<ul style="list-style-type: none"> • Age • Gender • Operation/ • diagnosis • ICU LOS • EUROSCOREII • Total IV opioid intake • Fentanyl (mcg) • Remifentanyl (mg) • Propofol (mg) • Number of inotropes • Courses of antibiotics • Total enteral feed intake (mls) • Hours on mechanical ventilation 	<p><u>Constipation</u></p> <ul style="list-style-type: none"> • Hours to first bowel movement • Number of patients constipated within first 72 hours • Number of patients constipated within first 96 hours • Episodes of constipation (BNO in 72 hours) <p><u>Diarrhoea</u></p> <ul style="list-style-type: none"> • Days of diarrhoea (≥ 3 loose stools in 24 hours) • Output of ≥ 200mls in 24hours) • Number of faecal management systems in situ 	<p><u>Composite</u></p> <ul style="list-style-type: none"> • Overall compliance • Nurse documented compliance <p><u>Other</u></p> <ul style="list-style-type: none"> • Type of laxatives administered. • Time laxatives started from enteral feed commencing. • Number of patients receiving PR assessment • Number of days of documented bowel assessment.

2 *ICU LOS* Intensive Care Unit Length of Stay, *IV* Intravenous, *BNO* Bowels Not Open, *PR* Per Rectum

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Implementation Process

1. How were you made aware of the bowel management protocol?
2. How could have the bowel management protocol been implemented better in practice?

Guideline Characteristics

3. What do you like about the bowel management protocol?
4. What don't you like about the bowel management protocol?

Institutional Characteristics

5. What makes the protocol easy to use/what do you think are the enablers to the bowel management protocol.
6. What are the barriers to using the bowel management protocol/what makes it difficult to use in practice?

Provider Attitudes

7. How do you think the bowel management protocol has altered the care given to the patients on CICU?
8. Do you have any ideas to improve the bowel management protocol?
9. Do you have any other comments you would like to make about the bowel management protocol?

1 **Table 4** Demographic and clinical characteristics of patient sample

Demographics and clinical characteristics	Pre-implementation <i>n</i> (%)	Post-implementation <i>n</i> (%)	Test Statistics
Gender: Male	21 (70)	15 (71.4)	$\chi^2 = .028$, $df = 1$, $p = .87$
Female	9 (30)	5 (23.8)	
Operation: CABG	8 (26.7)	3 (14.3)	†
Valve repair/replacement	7 (23.3)	9 (42.9)	
CABG + valve repair/replacement	5 (16.7)	5 (23.8)	
Multiple valve repair/replacement	3 (10)	-	
Type A dissection repair	4 (13.3)	3 (14.3)	
Other	3 (9.9)	1 (4.8)	
	<i>Md (IQR)</i>	<i>Md (IQR)</i>	
Age	73 (65.50 – 76.75)	69 (60 – 77.5)	$U = 285.50$, $z = -.565$, $p = .572$, $r = 0.079$, $r^2 = 0.006$
ICU LOS (days)	7.67 (5.89 – 15.09)	6.98 (5.10 – 15.38)	$U = 286.50$, $z = -.545$, $p = .585$, $r = 0.076$, $r^2 = 0.005$
Hours of MV	88.64 (22.86 – 159.50)	64 (44.37 – 289.09)	$U = 299$, $z = -.306$, $p = .759$, $r = 0.043$, $r^2 = 0.001$
EuroSCORE II	3.66 (2.23 – 14.04)	3.31 (1.99 – 9.42)	$U = 308$, $z = -.134$, $p = .893$, $r = 0.019$, $r^2 = 0.0003$
Total IV fentanyl intake (mcg)	350.00 (0 – 7639.79)	2300.00 (0 – 8562.20)	$U = 294$, $z = -.422$, $p = .673$, $r = 0.0619$, $r^2 = 0.003$
Total IV remifentanil intake (mg)	1.77 (0 – 9.5)	7.20 (0 – 26.85)	$U = 263$, $z = -.761$, $p = .446$, $r = 0.106$, $r^2 = 0.011$
Total IV propofol intake (mg)	13625.00 (2775.00 – 21878.75)	9400.00 (4603.34 – 19316.25)	$U = 312.50$, $z = -.048$, $p = .962$, $r = 0.007$, $r^2 = 0.00004$
Total enteral feed intake (ml)	7107.29 (2695.50 – 10349.06)	2565.00 (1150.00 – 14501.79)	$U = 253$, $z = -1.187$, $p = .235$, $r = 0.1662$, $r^2 = 0.0276$
Course of antibiotics	3 (2-3)	3 (2-3)	$U = 288$, $z = -.556$, $p = .578$, $r = 0.0778$, $r^2 = 0.006$
Number of inotropes	2 (1-3)	2 (1.5 – 2)	$U = 269.50$, $z = -.909$, $p = .363$, $r = 0.1273$, $r^2 = 0.0162$

1 CABG Coronary Artery Bypass Graft, PE Pleural Effusion, LOS Length of Stay, IV Intravenously, MV
2 Mechanical Ventilation, † Chi-square assumption violated

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2 **Table 5** Results from constipation and diarrhoea outcomes

	Pre-implementation	Post-implementation	Test Statistic
Hours until first bowel movement <i>Md (IQR)</i>	96.52 (72.59-128.10)	108 (97.98 – 119.23)	$U = 266, z = -.938, p = .348, r = 0.0487, r^2 = 0.0023$
Episodes (%) of constipation (BNO < 72 hours) <i>Md (IQR)</i>	14.29 (6.67 – 20)	14.29 (5.5 – 20)	$U = 282.50, z = -.626, p = .531, r = 0.0743, r^2 = 0.0055$
Constipated within first 72 hours: <i>n (%)</i>			
Yes	23 (76.7)	19 (90.5)	$p = .28 \uparrow$
No	7 (23.3)	2 (9.5)	OR = 0.346 95% CI = 0.0641 to 1.8648
Constipated within first 96 hours: <i>n (%)</i>			
Yes	15 (50)	17 (81)	$\chi^2 = 3.8, df = 1, p = .05$
No	15 (50)	4 (19)	OR = 0.2353 95% CI = 0.0639 to 0.8662
Percentage of diarrhoea days, <i>Md (IQR)</i>	2.17 (0-20)	0 (0 – 16.07)	$U = 283, z = -.644, p = .507, r = 0.0901, r^2 = 0.0081$
Patients who developed diarrhoea: <i>n (%)</i>			
Yes	15 (50)	9 (42.9)	$\chi^2 = .048, df = 1, p = .827$
No	15 (50)	12 (57.1)	OR = 1.3333 95% CI = 0.4341 to 4.0952
Faecal management system? <i>n (%)</i>			
Yes	7 (23.3)	0 (0)	$p = .03 \uparrow$
No	23 (76.7)	21 (100)	OR = 13.7234 95% CI = 0.7387 to 254.9363

3 BNO Bowels Not Open \uparrow Fisher Exact Test

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1 **Table 6** Outline of the thematic analysis process

Codes	Themes	Sub-themes	Cross reference to Cahill et al (2010)
BMP: easy to read; straightforward; simple, structured. Initially overwhelming Lots of boxes 'Absorbing' statement vague Is BMP applicable for TPN fed patients? Is BMP applicable for vascular patients?	<u>Barriers and Enablers to the BMP characteristics</u>		User-friendly format Information overload Vague or complex sentences Lack of generalisability to specific patient groups
Dissemination: word of mouth; clinical educator; email; reminders on Innovian; nurse in charge; one-to-one education. Not all received one-to-one. Uncertain how they were informed. Lack of BMP availability Need more; fixed to wall. Recommendations of other dissemination methods: safety brief; team meeting; ward meeting. Lack of suppositories in stock Skipping steps on protocol when no stock	<u>Barriers and Enablers of the dissemination</u>		Support of clinical educator Reminders Use of email and web-based tools. Displacement of information Lack of appropriate materials
Drs: refusing to prescribe aperients; questioning content of BMP; not always following BMP (CHDU) No medical resistance; Drs happy to prescribe aperients and follow BMP (CICU) Drs resistance to perform PR (CICU)	<u>Medical Involvement</u>		Physician resistance v shared team goals
PR examination: lack of confidence; grey area; no competencies; need for training Drs resistance to perform PR (CICU) Uncertainty over: patient's last bowel movement, patient's nutritional intake. Bowel movement not always documented pre-op. Nutritional intake not always documented Nutritional assessment subjective	<u>Barriers to bowel assessment</u>		A lack of possession of skills and training to perform procedure (An enabler in Cahill et al (2010), but reversed to make a barrier)
Variation in bowel care Nurses not escalating care as per BMP Previous practices interfering; reluctance to change Nurses compliant with following 'constipation' algorithm; less compliant following 'diarrhoea' algorithm Reluctance to send stool specimen Difficulties in barrier nursing with increased workload and delays in discharge.	<u>Nurse as a barrier</u>		Inertia of previous practice, especially among experienced staff.
Raised awareness of bowel and nutritional intake Forefront of mind; acting early Opening bowels more and quicker A uniform approach Constipation less common Patients reassured Patients needing the commode more frequently. Barrier nursing increases workload.	<u>BMP Outcomes</u>	Increased awareness Improved patient care Increased workload	NA

BMP Bowel Management Protocol, *TPN* Total Parental Nutrition, *PR* Per Rectum, *CHDU* Cardiac High Dependency Unit, *CICU* Cardiac Intensive Care Unit

1 **Table 7** Identified barriers and action plan for CICU

Barrier	Action Plan
BMP appearance overwhelming	Simplify the BMP
Statements on BMP not clear.	Ensure its elements are clearly stated.
Inconsistent methods of dissemination to staff.	Additional one-to-one interactions and teaching sessions for staff to explain the elements of the BMP and the implications of its use in practice.
Misinterpretation of the BMP.	
Reluctance to change previous practices.	
Lack of a multi-disciplinary approach of bowel management.	Inform anaesthetic lead consultant of findings. Ward round templates to include 'bowel' element for doctors to complete.
Lack of nurse confidence in performing a rectal assessment.	Provide guidelines to nurses on performing rectal assessment.
Poor documentation of patients' nutritional intake and bowel function.	Set up reminders about the importance of documentation

2 *BMP* Bowel Management Protocol.

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